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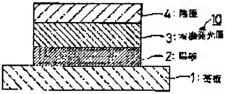
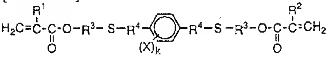
(54) ORGANIC ELECTROLUMINESCENT ELEMENT AND MANUFACTURE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a manufacturing method enabling light weight, superior mechanical strength and high productivity by providing an organic electroluminescent element and a substrate consisting of a light curing resin so as to be surface roughness (Rz) of one plate face of the substrate.
SOLUTION: An organic electroluminescent element 10 comprises a substrate 1, an anode 2, an organic luminescent layer 3, and a cathode 4, and the substrate 1 is a support of an entire element. Superior optical characteristics, heat resistance, surface precision, mechanical strength, light weight, and gas barrier properties are required. Light double refraction of a photocuring resin substrate is preferably 20nm or less. Thickness of the substrate is ordinary 0.1 to 5mm or preferably 0.3 to 1mm. Surface roughness on a luminescent element fabrication face of a resin substrate is 1 to 50nm in 10-point average roughness Rz and is preferably 2 to 20nm. When Rz is greater than 50nm, short circuit is likely to occur between element electrodes, and when it is smaller than 1nm, adhesive force between an organic layer and the substrate is weakened and is not preferable.



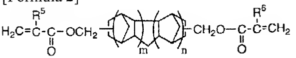
CLAIMS

[Claim(s)]
[Claim 1]Organic electroluminescence devices which it is the organic electroluminescence devices by which the anode, an organic luminous layer, and the negative pole were laminated on one plate surface of a substrate, and this board consists of photo-setting resins, and are characterized by surface roughness (Rz) of this one plate surface of a substrate being 1-50 nm.
[Claim 2]The organic electroluminescence devices according to claim 1, wherein a photo-setting resin carries out photopolymerization of the monomer containing polyfunctional (meta) acrylate which has two or more functional groups to intramolecular and is obtained.
[Claim 3]Polyfunctional (meta) acrylate which has two or more functional groups in intramolecular, The organic electroluminescence devices according to claim 2 being at least one sort of bis(meta)acrylate chosen from a group which consists of a compound expressed with a compound and following general formula [II] which are expressed with following general formula [I].
[Formula 1]



[I]

(The above-mentioned [I] R^1 and R^2 among a formula) The hydrocarbon group of the carbon numbers 1-6 in which hydrogen or a methyl group, R^3, and R^4 may contain the ether group and/or the thioether group, respectively, and X show the alkyl group or alkoxy group of a halogen atom or the carbon numbers 1-6, and k shows the integer of 0-4, respectively.
[Formula 2]



[II]

(R^5 and R^6 show hydrogen or a methyl group among the above-mentioned [II] type, respectively, and, as for 1 or 2, and n, m shows 0 or 1.)
[Claim 4]The organic electroluminescence devices according to claim 2 or 3, wherein a photo-setting resin carries out copolymerization of the polyfunctional mercapto compound which has two or more functional groups to polyfunctional (meta) acrylate and intramolecular which have two or more functional groups in intramolecular and is obtained.
[Claim 5]Organic electroluminescence devices given in any 1 paragraph of Claims 1-4, wherein

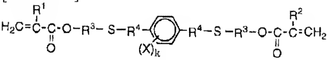
a substrate comprises a photo-setting resin of 20 nm or less of double reflexes.
[Claim 6]In a method of laminating the anode, an organic luminous layer, and the negative pole, and manufacturing organic electroluminescence deviees on a substrate, A manufacturing method of organic electroluminescence devices consisting of photo-setting resins and laminating the anode, an organic luminous layer, and the negative pole to this one plate surface of this substrate as this board using a substrate whose surface roughness (Rz) of plate surface of one [at least] of these is 1-50 nm.
[Claim 7]A manufacturing method of the organic eleetroluminescenee devices according to claim 6, wherein a photo-setting resin carries out copolymerization of the polyfunctional mercapto compound which has two or more functional groups to polyfunctional (meta) acrylate and intramolecular which have two or more funetional groups in intramolecular and is obtained.
[Claim 8]A manufacturing method of the organic electroluminescence devices according to claim 7, wherein a substrate carries out size enlargement of the photoresist monomer containing polyfunctional (meta) acrylate and a polyfunctional mercapto compound to tabular, irradiates this with an activity energy line and is manufactured by carrying out photopolymerization hardening.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to organic electroluminescence devices and a manufacturing method for the same, and relates to improvement of the supporting board of the thin film type light emitting device which emits light applying an electric field to the luminous layer which consists of organic compounds in detail.
[0002]
[Description of the Prior Art]Although what doped Mn which is a luminescence center, and rare earth elements (Eu, Ce, Tb, Sm, etc.) is common to ZnS and CaS which are II-group IV compound semiconductors of an inorganic material, SrS, etc. as a thin film type electroluminescence (EL) element conventionally, ** alternating current drive is needed for the EL element produced from the above-mentioned inorganic material (generally 50-1000 Hz).
** Driver voltage is high (about [Generally 200] V).
** Full-color-izing is difficult. There is a problem blue especially.
** The cost of a circumference drive circuit is high.
It has the said problem.
[0003]However, development of the EL element using an organic thin film came to be performed in recent years that the above-mentioned problem should be improved. In order to raise luminous efficiency especially, the kind of electrode is optimized for the purpose of the improve efficiency of carrier pouring from an electrode, By development (Appl.Phys.Lett., 51 volumes, 913 pages, 1987) of the organic electroluminescence devices which provided the organic electron hole transporting bed which comprises aromatic diamine, and the organic luminous layer which comprises the aluminium complex of 8-hydroxyquinoline. An extensive improvement of luminous efficiency is made as compared with the electroluminescence devices using single crystals, such as the conventional anthracene, and the practical use characteristic is

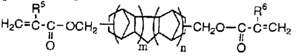
approached.
[0004]Besides the electroluminescence devices using the above low molecule materials, as a material of an organic luminous layer, Poly (p-phenylenevinylene) (Nature, 347 volumes, 539 pages, 1990, etc.), poly [2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (Appl.Phys.Lett., 58 volumes, 1982 pages, etc.). Development of the electroluminescence devices using polymer materials, such as poly (3-alkyl thiophene) (Jpn.J.Appl.Phys, 30 L 1938 pages, etc.), Development of the element (applied physics, 61 volumes, 1044 pages, 1992) which mixed a low-molecular luminescent material and electronic transition material to Polymer Division, such as a polyvinyl carbazole, is also performed.
[0005]In organic electroluminescence devices as shown above, glass is usually used as a substrate. However, in the display panel of the personal computer regarded as the use with important organic electroluminescence devices, or a portable terminal, When glass is used as a substrate, a weight saving and slimming down have a limit from low-density-izing of glass, and the problem of a mechanical strength, and also there is a problem from a viewpoint of a moldability and processability also in respect of improvement in productivity. For this reason, development of organic electroluminescence devices using the plastic as a substrate is desired strongly.
[0006]
[Problem(s) to be Solved by the Invention]However, there were the following problems in the conventional plastic plate.
[0007](1) Transparency and an optical property suitable for organic electroluminescence devices must have been satisfied.
(2) It is inferior to heat resistance.
(3) It is inferior to surface accuracy.
About the optical isotropy, the actual condition is over 10 nm by the plastic plate especially to double reflex deltan-d of a glass substrate being 1 nm or less. When a certain extension operation or flow operation of material adopts the molding method given to resin, it is difficult for the problem of this birefringence to solve this. When considering it as a comparatively thick substrate (for example, 0.4 mm or more), in extrusion and belt formation of thermoplastics, shaping is difficult. On the other hand, when thermosetting resin is used, shaping takes several hours and there is a problem in respect of productivity.
[0008]This invention solves the above-mentioned conventional problem, and it has transparency and an optical property suitable for organic electroluminescence devices, and excels in heat resistance and surface accuracy, and using a good plastic plate, a moldability is also lightweight and is aimed at providing organic electroluminescence devices excellent in a mechanical strength and productivity, and a manufacturing method for the same.
[0009]
[Means for Solving the Problem]Organic electroluminescence devices of this invention are the organic electroluminescence devices by which the anode, an organic luminous layer, and the negative pole were laminated on one plate surface of a substrate, and this substrate consists of photo-setting resins, and it is characterized by surface roughness (Rz) of this one plate surface of a substrate being 1-50 nm.
[0010]If it is a substrate made of a photo-setting resin, can carry out size enlargement of the photoresist liquefied monomer to tabular, can fabricate a substrate easily by irradiating with and carrying out polymerization curing of the activity energy line to this monomer, and moreover, if it is such a substrate made of a photo-setting resin, It has transparency and an optical property

suitable for organic electroluminescence devices, and excels also in heat resistance or surface accuracy.
[0011]It becomes possible to form an element composition layer in a substrate with a sufficient adhesive property, without a lamination side, i.e., the anode, an organic luminous layer, and the negative pole of a substrate causing a short cireuit of an element by making into the range of 1-50 nm surface roughness (Rz) of a field (the following "light emitting device production side" is called.) by which laminating formation is carried out.
[0012]It is preferred that it is what is produced by making carry out photopolymerization of the monomer containing polyfunctional (meta) acrylate to which a photo-setting resin has two or more functional groups in intramolecular in this invention, As for polyfunctional (meta) acrylate which has two or more functional groups in this intramolecular, it is preferred that it is at least one sort of bis(meta)acrylate chosen from a group which consists of a compound which is a compound and following general formula [II] whieh are expressed with following general formula [I], and is expressed.
[0013]
[Formula 3]



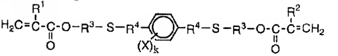
[I]

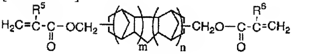
[0014](The above-mentioned [I] R^1 and R^2 among a formula) The hydrocarbon group of the carbon numbers 1-6 in which hydrogen or a methyl group, R^3, and R^4 may contain the ether group and/or the thioether group, respectively, and X show the alkyl group or alkoxy group of a halogen atom or the carbon numbers 1-6, and k shows the integer of 0-4, respectively.
[0015]
[Formula 4]



[II]

[0016](R^5 and R^6 show hydrogen or a methyl group among the above-mentioned [II] type, respectively, and, as for 1 or 2, and n, m shows 0 or 1.)
As for especially the photo-setting resin concerning this invention, it is preferred that it is what is produced by making carry out copolymerization of the polyfunctional mercapto compound which has two or more functional groups to the polyfunctional (meta) acrylate and intramolecular which have two or more functional groups in intramolecular.
[0017]As for a substrate, it is preferred to comprise a photo-setting resin of 20 nm or less of double reflexes.
[0018]In a method of such organic electroluminescence devices of this invention laminating the anode, an organic luminous layer, and the negative pole on a substrate, and manufacturing organic electroluminescence devices, It is manufactured from consisting of photo-setting resins as this substrate, and laminating the anode, an organic luminous layer, and the negative pole to this one plate surface of this substrate using a substrate whose surface roughness (Rz) of plate surface of one [at least] of these is 1-50 nm.
[0019]In this invention, a substrate carries out size enlargement of the photoresist liquefied monomer which contains preferably a polyfunctional mercapto compound which has two or more functional groups in polyfunctional (meta) acrylate and intramolecular which have two or

more functional groups in intramoleeular to tabular, This is irradiated with an activity energy line and it is manufactured by carrying out photopolymerization hardening.
[0020]
[Embodiment of the Invention]Below, organic electroluminescence devices of this invention and a manufacturing method for the same are explained, referring to Drawings.
[0021]drawing 1 - 3 are typical sectional views for which the constructional example of the organic electroluminescence devices of this invention is shown -- the inside of a figure, and 1 -- a substrate and 2 -- as for an electron hole transporting bed and 3b, an organic luminous layer and 3a are [the negative pole, and 10, 10A and 10B of an electron transport layer and 3c] organic electroluminescence devices a hole injection layer and 4 the anode and 3.
[0022]The substrate 1 serves as a base material of organic electroluminescence devices, and to exeel in the characteristics, such as optical property, heat resistanee, surface accuracy, mechanical-strength, lightweight nature, and GASUBARIA nature, is demanded. As a plastic plate which was excellent in these characteristics in this invention, the substrate made of a photo-setting resin is adopted. The substrate material used for below by this invention is explained.
[0023]The substrate concerning <polyfunctional (meta) acrylate> this invention, For example, as polyfunctional (meta) acrylate. Size enlargement of the photoresist monomer composition containing one sort or two sorts or more of bis(meta)acrylate chosen from the group which consists of alicycle skeleton bis(meta)acrylate shown by the ** sulfur bis(meta)acrylate and following general formula [II] which are shown by following general formula [I] is carried out, This is irradiated with an activity energy line and it comprises a photo-setting resin which comes to carry out photopolymerization hardening.
[0024]
[Formula 5]

[I]

[0025]
[Formula 6]

[II]

[0026]Each sign in the above-mentioned general formula [I] and [II] has a following meaning. R^1 and R^2: A hydrogen atom or a methyl group. R^1 and R^2 may be the same, or may differ from each other.
[0027]R^3 : An ether group (ether bond: C-O-C), a hydrocarbon group of the carbon numbers 1-6 which may contain a thioether group (thioether bond: C-S-C), A hydrocarbon group of the carbon numbers 1-6 which may contain the alkylene group R^4:ether group of the carbon numbers 2-4, and a thioether group preferably, desirable -- integer R^5 of the alkylene group X:halogen atom of the carbon numbers 1-3, an alkyl group of the carbon numbers 1-6, or the alkoxy group k:0-4 and an R^6:hydrogen atom, or a methyl group. m:1 which may be the same as for R^5 and R^6, or may differ, 2n:0, or 1 -- in addition, "It contains", and the constituent concerned is a range which does not spoil the meaning of this invention, and also means that a little auxiliary ingredients other than polyfunctional (meta) acrylate may be included. [of the above "photoresist monomer composition containing acrylate (meta)"] That is, it means that auxiliary

ingredients, such as the above-mentioned polyfunctional (meta) acrylate specified as the main ingredients of a photoresist monomer composition by this invention and other copolymerizable monomers, may be included in the range up to about 30 weight sections to photoresist monomer composition 100 weight section, for example like the after-mentioned. Each ingredient in this constituent may use together two or more of those kinds between ingredients and/or in an ingredient.
[0028]In this Description, "acrylate (meta)" names acrylate and/or methacrylate generically.
[0029]As an example of a ** sulfur bis(meta)acrylate compound shown by said general formula [I], for example, p-bis(beta-methacryloiloxy-ethyl thio)xylylene (R^1: -- methyl.) R^2 : Methyl, R^3:ethylene, R^4:methylene, k:0, p-bis(beta-acryloyloxyethyl thio)xylylene, m-bis(beta-methacryloiloxy-ethyl thio)xylylene, m-bis(beta-acryloyloxyethyl thio)xylylene, p-bis(beta-methacryloiloxy-ethyl oxyethylthio)xylylene, p-bis(beta-methacryloiloxy-ethyl thio)xylylene, p-bis(beta-methacryloiloxy-ethyl thio)tetra bromine xylylene, m-bis(beta-methacryloiloxy-ethyl thio)tetrachloro xylylene, etc. are mentioned.
[0030]These compounds are compoundable by a method shown, for example in JP,S62-195357,A.
[0031]As an example of an alicycle skeleton bis(meta)acrylate compound shown by said general formula [II], $5.2.0^{2,\ \mathrm{bis(oxymethyl)tricyclo}\ [6}$] Deccan = diacrylate, $5.2.0^{2,\ \mathrm{bis(oxymethyl)tricyclo}\ [6}$] Deccan = dimethacrylate, $5.2.0^{2,\ \mathrm{bis(oxymethyl)tricyclo}\ [6}$] Deccan = acrylate methacrylate, And these mixtures, bis(oxymethyl)pentacyclo [$6.5.1.1^{3,6}.0^{2,7}.0^{9,13}$] pentadecane = diacrylate, Bis(oxymethyl)pentacyclo [$6.5.1.1^{3,6}.0^{2,7}.0^{9,13}$] pentadecane = dimethacrylate, Bis(oxymethyl)pentacyclo [$6.5.1.1^{3,6}.0^{2,7}.0^{9,13}$] pentadecane = acrylate methacrylate and these mixtures are mentioned. These tricyclodecane compounds and two or more sorts of pentacyclo pentadecane compounds may be used together by the inside of a group, or being between groups.
[0032]These compounds are compoundable by a method shown, for example in JP,S62-225508,A.
[0033]Polyfunctional (meta) acrylate expressed with said general formula [I] and [II] can be independent, or can use two or more sorts together, and can be used. When using a compound of general formula [I] independently, a refractive index of a substrate obtained turns into a comparatively high refractive index of 1.55-1.65 at a room temperature in a D line (589.3 mm) of sodium. On the other hand, when using a compound of general formula [II] independently, it becomes a comparatively low refractive index called 1.47-1.55. Therefore, a low double reflex resin substrate which has a desired refractive index between 1.47-1.65 can be obtained by using together respectively one or more sorts of compounds expressed with general formula [I] and [II].
[0034]it also just [said] carried out that a substrate material concerning <auxiliary-ingredients> this invention may come to carry out polymerization curing of the polyfunctional (meta-) acrylate content photoresist monomer composition for which polyfunctional (meta-) acrylate is used as an essential ingredient, and this photoresist monomer composition could contain a little auxiliary ingredients.
[0035]Therefore, other monomers in which a radical polymerization and addition condensation are possible are mixed in quantity up to about 30 weight sections to photoresist monomer composition 100 weight section before the hardening, copolymerization is carried out to the above-mentioned polyfunctional (meta) acrylate, and a resin substrate concerning this invention can also be manufactured. As other monomers used in that case, for example Methyl (meta) acrylate, Phenyl (meta) acrylate, 2-hydroxyethyl (meta) acrylate, A methacryloyloxy

methyltetracyclo dodecane, methacryloyloxy methyltetracyclo dodecen, Ethylene glycol di(metha)aerylate, diethylene GURIKORUJI (meta) aerylate, I,6-hexanediol di(metha)acrylate, 2,2-bis[4-(beta-methacryloyl oxyethoxy) phenyl] propane, 2,2'-bis[4-(beta-methacryloyl oxyethoxy) cyclohexyl] propane, Acrylate eompounds, such as 1,4-bis(methacryloyl oxymethyl)cyclohexane and TORIMECHI roll pro pantry (meta) acrylate (meta), Although cores, such as styrene, KURORU styrene, divinylbenzene, and alpha-methylstyrene, and/or side ehain substitution, unsubstituted styrene, etc. are mentioned, One sort or two sorts or more of mercapto compounds chosen from a group which becomes the intramolecular shown by following general formula [Ill], [IV], and [V] preferably from a mercapto compound which has two or more thiol groups are mentioned.

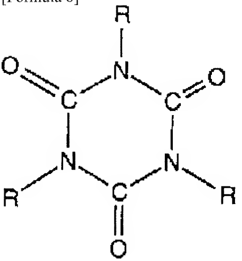
[0036]

[Formula 7]

$$\left(HS-R^7-\overset{\overset{O}{\|}}{C}-O\right)_a R^8 \qquad [III]$$

[0037]

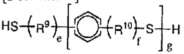
[Formula 8]



[IV]

[0038]

[Formula 9]



[V]

[0039]The above-mentioned general formula [III], [IV], and [V] Each inner sign has a following meaning.

[0040]R^7: -- methylene group or ethylene R^8: -- the hydrocarbon group of the carbon numbers 2-15 which may contain the ether group and the thioether group. It is integer R:HS-$(CH_2\text{-})_b$(CO)-$(OCH_2)_d$-$(CH_2\text{-})_c$ of the hydrocarbon group a:2-6 of the carbon numbers 2-6 preferably. -(however, b and c the integer of 0-2 and d integer of I-4)

R^9: -- hydrocarbon-group R^{10}: of the carbon numbers 1-3 -- a mercapto compound shown by the hydrocarbon group e of the carbon numbers 1-3, f:0, Ig:I, or 2 above-mentioned general formula [III] is thioglycolic acid ester or thio propionate ester of 2 - 6 value. As an example of a

compound of formula [III], for example Pentaerythritol tetrakis (beta-thiopropionate), Pentaerythritol tetrakis (thioglycolate), trimethylolpropanetris (beta-thiopropionate), Trimethylolpropanetris (thioglycolate), a diethylene-glyeol screw (beta-thiopropionate), A diethylene-glycol screw (thioglycolate), a triethylene glycol screw (beta-thiopropionate), A triethylene glycol screw (thioglycolate), dipentaerythritol hexa eis- (beta-thiopropionate), dipentaerythritol hexa cis- (thioglycolate), etc. are mentioned.

[0041]A compound shown by general formula [IV] is X-sulfhydryl group content TORIISO cyanurate. As an example of a compound of formula [IV], for example Tris [2-(beta-thio propionyloxy) ethyl] isocyanurate, Tris (2-CHIOGURIKO nil oxyethyl) isocyanurate, tris [2-(beta-thio propionyloxy ethoxy) ethyl] isocyanurate, Tris (2-CHIOGURIKO nil oxyethoxy ethyl) isocyanurate, tris [3-(beta-thio propionyloxy) propyl] isocyanurate, tris (3-CHIOGURIKO nil oxypropyl) isocyanurate, etc. are mentioned.

[0042]Compounds shown by general formula [V] are alpha and X-sulfhydryl group content compound. As an example of a compound of formula [V], pen ZENJI mercaptan, xylylene JIMERU captan, a 4,4'-dimercapto diphenylsulfide, etc. are mentioned, for example.

[0043]By blending these mercapto compounds, an operation as a chain transfer agent which a thiol group has is effectively demonstrated in manufacture of a resin substrate, polymerization curing is advanced uniformly quietly, and a double reflex of hardening resin obtained can be reduced. Moderate toughness is given to a resin substrate from which these mercapto compounds are obtained by entering into the three-dimensional network structure formed of bis(meta)acrylate. A double reflex, mechanical strength, etc. can be improved by having two or more thiol groups in intramolecular, namely, using a polyfunctional mercapto compound for it, without spoiling the heat resistance of hardening resin obtained greatly.

[0044]When using together said polyfunctional (meta) acrylate and the above-mentioned mercapto compound, as a substrate material concerning this invention the presentation rate, It is the range of one to mercapto compound 20 weight section which is considered as 0.1 to mercapto compound 30 weight section to 70 to polyfunctional (meta) acrylate 99.9 weight section to 80 to polyfunctional (meta) acrylate 99 weight section desirable still more preferably. If there are too few rates of a mercapto compound, the double reflex improvement effect of hardening resin will no longer be acquired, and if too conversely large, the heat resistance of hardening resin will become low.

[0045]As auxiliary ingredients, an antioxidant, an ultraviolet ray absorbent, dyes and pigments, a bulking agent, etc. besides the above-mentioned mercapto compound can be used.

[0046]Size enlargement of the photoresist monomer composition concerning <size enlargement and polymerization curing> this invention is carried out, and it is hardened. The hardening is carried out by a publicly known radical polymerization which adds a photopolymerization initiator which generates a radical with activity energy lines, such as ultraviolet rays. As a photopolymerization initiator used in that case, for example Benzophenone, benzoylmethyl ether, Benzoylisopropyl ether, a diethoxyacetophenone, 1-hydroxycyclohexylphenyl ketone, 2,6-dimethylbenzoyl diphenylphosphine oxide, 2 and 4, 6-methylbenzoyl diphenyphosphine oxide, etc. are mentioned. Among these, desirable photopolymerization initiators are 2,4,6-methylbenzoyl diphenyphosphine oxide and benzophenone. These photopolymerization initiators may use two or more sorts together.

[0047]An addition of these photopolymerization initiators is 0.02 to 0.3 weight section preferably 0.01 to 1 weight section to monomer 100 weight section. If there are too many additions of a photopolymerization initiator, it not only brings about increase of a double reflex,

but a polymerization will advance rapidly and hue will get worse. When too small, it becomes impossible to fully stiffen a photoresist monomer eomposition.
[0048]Quantity of an activity energy line with whieh it irradiates is arbitrary if a photopolymerization initiator is a range which generates a radical, but. Since a polymerization becomes imperfect, and the heat resistance of a hardened material and a mechanical characteristic are not fully revealed, but degradation by lights, such as yellowing of a hardened material, is produced when reverse extremely superfluous when extremely small, A presentation of a monomer and a kind of photopolymerization initiator, and quantity are preferably irradiated with 200 in all-400-nm ultraviolet rays in 0.1-200J. As an example of a lamp to be used, a metal halide lamp, a high-pressure mercury-vapor lamp lamp, etc. can be mentioned.
[0049]Thermal polymerization may be used together the making hardening complete promptly purpose. That is, a constituent and the whole mold are heated in 30-300 ** simultaneously with an optical exposure. In this case, in order to complete a polymerization better, a thermal polymerization initiator may be added, but that superfluous use brings about increase of a double reflex, and aggravation of hue. As an example of a thermal polymerization initiator, benzoyl peroxide, diisopropyl peroxy carbonate, tert-butyl peroxide (2-ethylhexanoate), etc. are mentioned, and one or less weight section of the amount used is preferred to monomer 100 weight section.
[0050]In this invention, after performing a radical polymerization by optical exposure, it is also possible by heating a hardened material to reduce internal distortion generated at the time of a conclusion of a polymerization reaction and a polymerization. In this case, although cooking temperature is suitably chosen according to a presentation and glass transition temperature of a hardened material, near glass transition temperature or temperature not more than it is preferred [superfluous heating] in order to bring about hue aggravation of a hardened material.
[0051]In the usual case, as a mold for size enlargement, a glass plate by which optical polish was carried out, and a silicon plate of predetermined thickness as a spacer are used. Since surface roughness of a glass plate to be used affects surface roughness of a resin substrate obtained, it needs to control surface roughness of a glass plate according to surface roughness needed for a resin substrate. As for the surface roughness Rz of a glass plate used as a mold, in order for the surface roughness Rz to obtain a resin substrate which is 2-50 nm generally, it is desirable that it is 0.2-20 nm. As a factor which affects surface roughness of a resin substrate, in addition to surface roughness of the above-mentioned glass plate, since there are an amount of UV irradiation, the amount of photoinitiators, etc., each parameter is determined if needed. For example, in order for the surface roughness Rz of a resin substrate to obtain what is 5-10 nm. The surface roughness Rz of a glass plate arranges a silicon plate as a spacer on this glass plate using what is 1-5 nm, A photoresist monomer composition which mixed and defoamed polyfunctional (meta) acrylate and auxiliary ingredients with specified proportion is poured in, and it irradiates with ultraviolet rays for 10 minutes between metal halide lamps of output 80 W/cm which was isolated from a glass surface as for 40 cm of upper and lower sides.
[0052]As for an optical double reflex of a substrate made of a photo-setting resin applied to this invention from a field of an optical property as a substrate for the <physical properties of resin substrate> organicity electroluminescence devices, it is preferred that it is 20 nm or less.
[0053]In the usual case, thickness of a resin substrate concerning this invention is 0.3-1 mm preferably 0.1-5 mm.
[0054]1-50 nm of surface roughness by the side of the light emitting device production sides of a resin substrate concerning this invention is 2-20 nm preferably in the ten-point average of

roughness height Rz. If Rz of a resin substrate becomes larger than 50 nm, by inter-electrode [of organic electroluminescence devices produced by substrate face], a short circuit takes place easily and it is not suitable as a substrate. When Rz is smaller than 1 nm, adhesive strength of an organic layer and a substrate which are formed in a substrate face becomes small, and an organic layer separates easily and it stops being suitable as a substrate too with stress at the time of vacuum evaporation of a subsequent negative pole metal layer etc.
[0055]Precise silicon oxide etc. may be provided at least in one side of a substrate in order to improve the GASUBARIA nature of this resin substrate more.
[0056]Next, a composition layer of organic electroluminescence devices of this invention using such a substrate made of a photo-setting resin is explained.
[0057]The anode 2 formed on the substrate 1 plays a role of a hole injection to the organic luminous layer 3. This anode 2 usually Aluminum, gold, silver, platinum, nickel, palladium, halogenated metals, such as metallic oxides, such as an oxide of metal, such as platinum, indium, and/or tin, and copper iodide, and carbon black -- or, Conductive polymers, such as poly (3-methylthiophene), polypyrrole, and poly aniline, etc. are preferably formed with indium tin oxide. Formation of the anode 2 is usually performed by sputtering process, a vacuum deposition method, etc. in many cases. When using particles, such as metal particles, such as silver, and copper iodide, carbon black, a conductive metal oxide particle, conductive polymer impalpable powder, etc., the anode 2 can also be formed by distributing this in a suitable binder resin solution, and applying on the substrate 1. When using a conductive polymer, the anode 2 can also be formed by forming a thin film on the substrate 1 directly by electrolytic polymerization, or applying a conductive polymer on the substrate 1 (Appl.Phys.Lett., 60 volumes, 2711 pages, 1992). The anode 2 can also laminate and form a different substance.
[0058]Thickness of the anode 2 changes with existence of a demand of transparency. When transparency is needed, it is desirable to usually make transmissivity of visible light into not less than 80% preferably not less than 60%, and 5-1000 nm of thickness is usually about 10-500 nm preferably in this case. When the anode 2 may be opaque, they may be the substrate 1 and an identical material. It is also possible to laminate a different electrical conducting material on the anode 2.
[0059]In inter-electrode [to which an electric field was given], the organic luminous layer 3 formed on the anode 2 is formed from material which conveys efficiently an electron hole poured in from the anode 2, and an electron poured in from the negative pole 4, and makes it recombine, and emits light efficiently by recombination. Usually, as this organic luminous layer 3 is shown in drawing 2 for improvement in luminous efficiency, making it a functional discrete type divided into the electron hole transporting bed 3a and the electron transport layer 3b is performed (Appl.Phys.Lett., 51 volumes, 913 pages, 1987).
[0060]In the functional discrete type organicity electroluminescence devices 10A shown in drawing 2, as a material of the electron hole transporting bed 3a, hole-injection efficiency from the anode 2 is high, and it is required to be the material which can convey a poured-in electron hole efficiently. For that purpose, ionization potential is small, and moreover hole mobility is large, and also it excels in stability, and it is required that it should be hard to generate an impurity which serves as a trap at the time of manufacture and use.
[0061]An aromatic diamine compound which connected the 3rd class aromatic amine units, such as 1,1-bis(4-di-p-tolylamino phenyl)cyclohexane, as such a hole transporting material, for example (JP,S59-194393,A), Aromatic amine which two or more fused aromatic rings replaced by a nitrogen atom including two or more tertiary amine represented with 4,4'-screw [N-(1-

naphthyl)-N-phenylamino] biphenyl (JP,H5-234681,A), Aromatictriamine which has starburst structure with a derivative of triphenylbenzene (US,4,923,774,B), Aromatic diamine, such as N,N'-diphenyl-N,N'-bis(3-methylphenyl)biphenyl 4,4'-diamine (US,4,764,625,B), alpha, alpha, alpha', alpha '- tetramethyl alpha and alpha'-bis(4-di-p-tolylamino phenyl)-p-xylene (JP,H3-269084,A), A compound which an aromatic diamino group replaced by triphenylamine derivative (JP,H4-129271,A) unsymmetrical in three dimensions and the Viret Nils group as the whole molecule (JP,H4-175395,A), Aromatic diamine which connected the 3rd class aromatic amine unit by ethylene (JP,H4-264189,A), Aromatic diamine which has styryl structure (JP,H4-290851,A), What connected an aromatic tertiary amine unit with a thiophene group (JP,H4-304466,A), Starburst typearomatictriamine (JP,H4-308688,A), A benzylphenyl compound (JP,H4-364153,A), a thing which connected tertiary amine by a fluorene group (JP,H5-25473,A), A triamine compound (JP,H5-239455,A), screw dipyridyl aminobiphenyl (JP,H5-320634,A), N, N, and N-triphenylamine derivative (JP,H6-1972,A), Aromatie diamine which has phenoxazine structure (JP,H7-138562,A), A diaminophenyl phenanthridine derivative (JP,H7-252474,A), A hydrazone compound (JP,H2-311591,A), a silazane compound (US,4,950,950,B gazette), a silanamine derivative (JP,H6-49079,A), a phosphamine derivative (JP,H6-25659,A), A quinacridone compound etc. are mentioned. These compounds may be used independently, and if needed, may mix two or more sorts and may be used.
[0062]except for the above-mentioned compound -- as the material of the electron hole transporting bed 3a -- a polyvinyl carbazole and polysilane (Appl.Phys.Lett. -- 59 volumes) 2760 pages, 1991, polyphosphazene (JP,H5-310949,A), Polyamide (JP,H5-310949,A), a polyvinyl triphenylamine (JP,H7-53953,A), Polymer Division which has a triphenylamine skeleton (JP,H4-133065,A), Polymer Division which connected a triphenylamine unit by a methylene group etc. (Synthetic Metals, 55 to 57 volumes, 4163 pages, 1993), Polymer materials, such as polymethacrylate (J. Polym.Sci., Polym.Chem.Ed., 21 volumes, 969 pages, 1983) containing aromatic amine, can be used.
[0063]Laminating formation of the electron hole transporting bed 3a is carried out on said anode 2 by forming these hole transporting materials with the applying method or a vacuum deposition method.
[0064]In the case of the applying method, one sort of a hole transporting material or two sorts or more, and additive agents that do not become a hole trap as occasion demands, such as binder resin and a spreading nature improving agent, are added, It dissolves in a solvent, a coating solution is prepared, this is applied and dried on the anode 2 by methods, such as a spin coat method, and the organic electron hole transporting bed 3a is formed. In this case, polycarbonate, polyarylate, polyester, etc. are mentioned as binder resin. Since hole mobility will be reduced if there are many additions of binder resin, few directions are desirable and 50 or less % of the weight is usually preferred.
[0065]On the other hand, in the case of a vacuum deposition method, a crucible is heated, after paying a hole transporting material to a crucible installed in a vacuum housing and exhausting inside of a vacuum housing even to a 10^{-4}Pa grade with a suitable vacuum pump, A hole transporting material is evaporated and the electron hole transporting bed 3a is formed on the anode 2 on the substrate 1 which carried out the placed opposite to a crucible.
[0066]Thus, when forming the electron hole transporting bed 3a, further as an acceptor, A metal complex and/or metal salt (JP,H4-320484,A) of aromatic carboxylic acid, A benzophenone derivative and a thio benzophenone derivative (JP,H5-295361,A), and fullerene (JP,H5-331458,A) are doped by 10^{-3}-10 % of the weight concentration, By making an electron hole as a

free career generate, a low voltage drive can be made possible.
[0067]10-300 nm of thickness of the electron hole transporting bed 3a is usually 30-100 nm preferably. In order to form uniformly a thin electron hole transporting bed of such thickness, it is preferred to adopt a vacuum deposition method generally.
[0068]As shown in drawing 3, forming the hole injection layer 3c between the electron hole transporting bed 3a and the anode 2 is also performed, in order to raise hole-injection efficiency further and to improve adhesion force to the anode 2 of the whole organic layer. As a material used for the hole injection layer 3c, ionization potential is low, Material in which conductivity can form a stable thin film thermally on the anode 2 highly is desirable, and a phthalocyanine compound and a porphyrin compound (JP,S57-51781,A, JP,S63-295695,A) are used. By making such a hole injection layer 3c intervene, an effect that a power surge when the continuation drive of the element is carried out by constant current is also controlled is acquired at the same time driver voltage of an early element falls. It is possible to raise conductivity with the hole injection layer 3c as well as the electron hole transporting bed 3a doping an acceptor.
[0069]2-100 nm of thickness of the hole injection layer 3c is usually 5-50 nm preferably. In order to form a thin hole injection layer of such thickness uniformly, it is preferred to adopt a vacuum deposition method generally.
[0070]In inter-electrode [to which an electric field was given], the electron transport layer 3b formed on the electron hole transporting bed 3a comprises a compound which can convey an electron from the negative pole in the direction of the electron hole transporting bed 3a efficiently.
[0071]As an electron-transport-property compound used for the electron transport layer 3b, electron injection efficiency from the negative pole 4 is high, and it is required to be a compound which can convey a poured-in electron efficiently. For that purpose, electron affinity is large, and moreover electron mobility is large, and also it excels in stability, and to be a compound which an impurity which serves as a trap at the time of manufacture and use does not generate easily is demanded.
[0072]As a material which fulfills such conditions, aromatic compounds, such as tetraphenylbutadiene (JP,S57-51781,A), Metal complexes, such as an aluminium complex of 8-hydroxyquinoline (JP,S59-194393,A), cyclopentadiene derivative (JP,H2-289675,A) and peri non -- a derivative (JP,H2-289676,A). an oxadiazole derivative (JP,H2-216791,A) and a screw styryl benzene derivative (JP,H1-245087,A.) a 2-222484 gazette and a perylene derivative (JP,H2-189890,A.) a 3-791 gazette and a coumarin compound (JP,H2-191694,A.) A 3-792 gazette, a rare earth complex (JP,H1-256584,A), A distyryl pyrazine derivative (JP,H2-252793,A), p-phenylene compound (JP,H3-33183,A), A thiadiazolo pyridine derivative (JP,H3-37292,A), a pyrrolo pyridine derivative (JP,H3-37293,A), a NAFUCHI lysine derivative (JP,H3-203982,A), etc. are mentioned.
[0073]Generally the electron transport layer 3b using these compounds can play simultaneously a role which conveys an electron, and an electron hole and a role which brings about luminescence in the case of electronic recombination.
[0074]When the electron hole transporting bed 3a has a luminescence function, the electron transport layer 3b may play only a role which conveys an electron.
[0075]While raising luminous efficiency of an element, are the purpose of changing the luminescent color, and an aluminium complex of 8-hydroxyquinoline is used as a host material, for example, Although doping fluorochromes for laser, such as a coumarin (J. Appl.Phys., 65 volumes, 3610 pages, 1989) etc. is performed, using the above-mentioned organic electron-

transport-property material as a host material also in this invention -- various kinds of fluorochromes -- 10^{-3} - 10-mol % -- the luminescent eharaeteristic of an element can be further raised by doping.
[0076]10-200 nm of thickness of the electron transport layer 3b is usually 30-100 nm preferably.
[0077]Although an electron transport layer can also be formed by the same method as an electron hole transporting bed, a vacuum deposition method is usually used.
[0078]As the organic luminous layer 3 of a monolayer type which does not perform functional separation as shown in drawing 1, Previously quoted poly (p-phenylenevinylene) (Nature, 347 volumes, 539 pages, 1990, etc.), poly [2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene] (Appl.Phys.Lett., 58 volumes, 1982 pages, 1991, etc.). A system (applied physics, 61 volumes, 1044 pages, 1992) etc. which mixed a luminescent material and electronic transition material are mentioned to polymer materials, such as poly (3-alkyl thiophene) (Jpn.J.Appl.Phys, 30 L 1938 pages, 1991, etc.), and Polymer Division, such as a polyvinyl carbazole.
[0079]The negative pole 4 plays a role which pours an electron into the organic luminous layer 3. Although the material used as the negative pole 4 can use material used for said anode 2, in order to perform electron injection efficiently, its low metal of a work function is preferred, and suitable metal or those alloys, such as tin, magnesium, indium, calcium, aluminum, and silver, are preferred for it. Thickness of the negative pole 4 is usually comparable as the anode 2.
[0080]When a work function laminates a stable metal layer to the atmosphere further highly on this negative pole, the stability of an element can be increased in order to protect the negative pole which consists of low work function metals. Metal, such as aluminum, silver, nickel, chromium, gold, and platinum, is used for a metal layer for this purpose.
[0081]Drawing 1 - 3 can show an example of an element body adopted by this invention, and this invention can be applied to an element body of lamination as shown below in addition to a thing of a graphic display.
[0082]The anode / electron hole transporting bed / electron transport layer / volume phase / negative pole, an electron transport layer/negative pole besides anode / electron hole transporting bed / electron transport layer/, By an electron transport layer / the negative pole above-mentioned lamination besides electron transport layer / volume phase / negative pole, anode / hole injection layer / electron hole transporting bed / electron transport layer / volume phase / negative pole, anode / hole injection layer / electron hole transporting bed / electron transport layer/. [besides anode / electron hole transporting bed / electron transport layer/] Are for a volume phase raising contact to the negative pole and an organic layer, and An aromatic diamine compound (JP,H6-267658,A), A quinacridone compound (JP,H6-330031,A), a naphthacene derivative (JP,H6-330032,A), An organic silicon compound (JP,H6-325871,A), an organophosphorus compound (JP,H6-325872,A), A layer which comprised a compound (Tokuganhei6-199562), N-vinylcarbazole polymer (Tokuganhei6-200942), etc. which have N-phenyl carbazole skeleton can be illustrated. 2-100 nm of thickness of a volume phase is usually 5-30 nm preferably. Instead of providing a volume phase, a field which includes material of the above-mentioned volume phase 50% of the weight or more near the negative pole interface of an organic luminous layer and an electron transport layer may be provided.
[0083]In order that other electron transport layers may raise luminous efficiency of organic electroluminescence devices further, it is required for a compound which laminating formation is further carried out on an electron transport layer, and is used for this electron transport layer that electron injection from the negative pole should be easy, and electronic transport capacity should be still larger. As such an electron-transport-property material, A system which distributed an

oxadiazole derivative (Appl.Phys.Lett., 55 volumes, 1489 pages, 1989, etc.) and them to resin, such as poly methyl methacrylate (PMMA) (Appl.Phys.Lett., 61 volumes, 2793 pages, 1992), A phenanthroline derivative (JP,H5-331459,A) or n type hydrogenation amorphous carbonization silicon, n type zinc sulfide, n type zinc selenide, etc. are mentioned. 5-200 nm of thickness of other electron transport layers is usually 10-100 nm preferably.

[0084]Organic electroluminescence devices of this invention are applicable to both a single element an element which consists of structure arranged at array form and an element of structure where the anode and the negative pole have been arranged in the shape of an X-Y matrix.

[0085]

[Example]Next, although working example and a comparative example are given and this invention is explained still more concretely, this invention is not limited to the description of the following working example, unless the gist is exceeded.

[0086]Working example 1p-bis(beta-methacryloiloxy-ethyl thio)xylylene 99 weight section, Pentaerythritol tetrakis (beta-thiopropionate) 1 weight section, After carrying out agitation mixing of 2,4,6-methylbenzoyl-diphenyphosphine-oxide ("RUSHIRIN TPO" by BASF A.G.) 0.05 weight section, and the benzophenone 0.02 weight section uniformly as a photopolymerization initiator, it defoamed and the photoresist monomer composition was obtained.

[0087]On the other hand, a 1-mm-thick silicon plate is used as a mold for carrying out size enlargement of the resin as the glass plate by which optical polish was carried out, and a spacer, The above-mentioned photoresist monomer composition was poured in the mold of this optical polish glass, and it irradiated with ultraviolet rays for 10 minutes between the metal halide lamps of output 80 W/cm which is in a vertical position with a distance of 40 cm from a glass surface. It released from mold after UV irradiation, it heated at 120 ** for 1 hour, and the hardened material was obtained. This hardened material was cut in the shape of slide glass (25x75 mm), and it was considered as the substrate A. The various characteristics of the substrate A were as being shown in Table 1. Evaluation of each characteristic was performed by the following methods.

[0088](1) Appearance : viewing estimated.

(2) Specific gravity : it evaluated by measuring the weight and volume of a specimen (width and 5 cm each in length, and 1 mm in thickness).

(3) Falling ball impact test : the minimum height that a specimen damages estimated by carrying out the natural fall of the 16-g steel ball to a specimen (width and 5 cm each in length, and 1 mm in thickness).

(4) The rate of bending flexibility : 25 ** estimated the board (1 cm in width, and 1 mm in thickness) using the autograph in the distance between fulcrums of 3 cm.

(5) Surface roughness Rz : the ten-point average of roughness height (JISB0601) estimated using the tracer type surface roughness meter (rank tailor Hobson TARISU tetraethylpyrophosphate: the tip shape of a sensing pin. 0.2x0.2-micrometer angle).

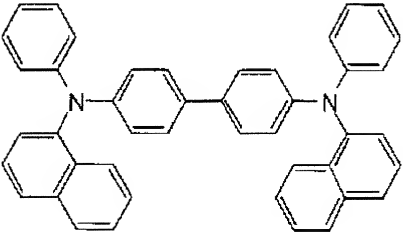
(6) Refractive index : 25 ** estimated using the Abbe refractometer (made by ATAGO).

(7) Double reflex : 25 ** estimated using the birefringence measuring apparatus (made by an oak company).

(8) Water absorption : saturation water absorption when it was underwater immersed for one week at 60 ** estimated.

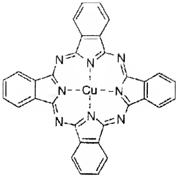
(9) Glass transition temperature : a 50-g load estimated the 1-mm-thick specimen using TMA

(apparatus for thermomeehanical analysis).
[0089]Next, the 120-nm deposition (Toyokazu industrial company make: low-temperature weld slag membrane formation article : 20ohms of sheet resistance) of the indium-tin-oxide (ITO) transparent conducting film was carried out on this substrate A, and it was considered as the ITO board A.
[0090]The organic electroluminescenee devices which have the structure shown in drawing 3 were produced by the following methods using this ITO board A. First, the ITO transparent conducting film deposited on the ITO board A was patterned after the stripe of 2-mm width using the usual photolithography technique and chloride etching, and the anode was formed.
[0091]The ITO board which carried out pattern formation was dried by the nitrogen blow after washing in order of ultrasonic cleaning by acetone, rinsing by pure water, and ultrasonic cleaning by isopropyl alcohol, finally the ultraviolet-rays ozone wash was performed, and it installed in the vacuum evaporator. It exhausted using the oil diffusion pump provided with the liquid nitrogen trap after the oil sealed rotary pump performed rough exhaust air of the device until the degree of vacuum in a device became below $2x10^{-6}$Torr (about $2.7x10^{-4}$Pa).
[0092]It vapor-deposited by heating the copper phthalocyanine (H1) (a crystal form is beta type) shown in the following put into the molybdenum boat arranged in the above-mentioned device. The steam was performed in degree-of-vacuum $1.1x10^{-6}$torr (about $1.5x10^{-4}$Pa), and vacuum evaporation time 1 minute, and formed the hole injection layer 3c of 20 nm of thickness.
[0093]
[Formula 10]



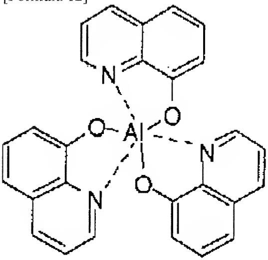
(H 1)

[0094]Next, the 4,4'-bis[N-(1-naphthyl)-N-phenylamino] bisphenol (H2) which was put into the ceramic crucible arranged in the above-mentioned device and which is shown below was heated with the tantalum wire heater around a crucible, and it laminated on the hole injection layer 3c. The temperature of the jar which gets at this time was controlled in 230-240 **. The electron hole transporting bed 3a of 60 nm of thickness was formed in degree-of-vacuum $8x10^{-7}$Torr at the time of vacuum evaporation (about $1.1x10^{-4}$Pa), and vacuum evaporation time 1 minute and 50 seconds.
[0095]
[Formula 11]



(H 2)

[0096]Then, as a material of the electron transport layer 3b which has a luminescence function, 8-hydroxyquinoline complex:aluminum(C_9H_6NO) $_3$ (E1) of the aluminum shown below was made into above-mentioned Mr. electron hole transporting bed 3a top ****, and was vapor-deposited. The temperature of the jar which gets at this time was controlled in 310-320 **. The degree of vacuum at the time of vacuum evaporation is $9x10^{-7}$Torr (about $1.2x10^{-4}$Pa), vacuum evaporation time is 2 minutes and 40 seconds, and the electron transport layer 3b of 75 nm of thickness was formed.
[0097]
[Formula 12]



(E 1)

[0098]When carrying out vacuum deposition of the hole injection layer 3c, the electron hole transporting bed 3a, and the electron transport layer 3b, substrate temperature was held to the room temperature.
[0099]The substrate in which the hole injection layer 3c, the electron hole transporting bed 3a, and the electron transport layer 3b were formed is once taken out from the inside of said vacuum evaporator in the atmosphere, As a mask for negative pole vacuum evaporation, the stripe shape shadow mask of 2-mm width, It was made to stick and provided so that it might intersect perpendicularly with the ITO stripe of the anode 2, and it exhausted until it installed in another vacuum evaporator and the degree of vacuum in a device became below $2x10^{-6}$Torr (about $2.7x10^{-4}$Pa) like the time of vacuum evaporation of each organic layer. Then, as the negative pole 4, the alloy electrode of magnesium and silver was vapor-deposited so that 2 yuan might become 100 nm of thickness with simultaneous vacuum deposition. Vacuum evaporation was performed

using the molybdenum boat in degree-of-vacuum $1x10^{-5}$Torr (about $1.3x10^{-3}$Pa), and vacuum evaporation time 3 minutes and 10 seconds. The atomic ratio of magnesium and silver was set to 10:1.2. Then, aluminum was laminated on magnesium and a silver alloy film by 100-nm thickness using the molybdenum boat, and the negative pole 4 was completed without breaking the vacuum of a device. The degree of vacuum at the time of the vacuum plating of aluminium was $2.3x10^{-5}$Torr (about $3.1x10^{-3}$Pa), and vacuum evaporation time was 1 minute and 40 seconds. The substrate temperature at the time of the above magnesium and silver alloy, and vacuum evaporation of the two-layer type negative pole of aluminum was held to the room temperature.

[0100]Organic electroluminescence devices with a size of 2 mm x 2 mm were obtained as mentioned above. After taking out this element from a negative pole evaporation apparatus, impress the direct current voltage of minus to the anode 2, plus and the negative pole 4 were made to emit light to it, and the luminescent characteristic was measured.

[0101]Change of light emitting luminance when changing impressed electromotive force at 1V step in 1-15V was shown in drawing 4. Light emitting luminanee when 15V is impressed to an element, the luminous efficiency of 15V, and L/J (quantity corresponding to quantum efficiency by inclination when the luminosity-current density eharacteristic was approximated in a straight line) were shown in Table 2.

[0102]The hardened material was obtained like working example 1 except having used the bis(oxymethyl)tricyclo [$5.2.1.0^{2.6}$] Deccan = dimethacrylate 96 weight section and pentaerythritol tetrakis (beta-thiopropionate) 4 weight section as working example 2 monomer component. This hardened material was cut in the shape of slide glass, and it was considered as the substrate B. The various characteristics of this substrate B were as being shown in Table 1.

[0103]Next, the ITO transparent conducting film was deposited on the substrate B in the same low-temperature sputtering technique as working example 1, and it was considered as the ITO board B. The sheet resistance values of this ITO board B were 20ohms.

[0104]The organic electroluminescence devices of the structure shown in drawing 3 like working example 1 using this ITO board B were produced, the luminescent characteristic was measured similarly, and the result was shown in drawing 4 and Table 2.

[0105]Comparative example 1 Corning, Inc. make 7059 glass was cut in the shape of slide glass, and it was considered as the substrate C. The various characteristics of this substrate C were as being shown in Table 1.

[0106]Next, the ITO transparent conducting film was deposited on this substrate C in the same low-temperature sputtering technique as working example 1, and it was considered as the ITO board C. The sheet resistance values of this ITO board C were 20ohms.

[0107]The organic electroluminescence devices of the structure shown in drawing 3 like working example 1 using this ITO board C were produced, the luminescent characteristic was measured similarly, and the result was shown in drawing 4 and Table 2.

[0108]Corning, Inc. make 7059 glass was used as the substrate like the comparative example 2 comparative example 1, the ITO transparent conducting film was deposited with electron beam evaporation method (made by Geomatec) on this substrate, and it was considered as the ITO board D. The sheet resistance values of this ITO board D were 15ohms. When the ITO board D was analyzed by X-ray diffraction, as compared with the ITO board C of the comparative example 1 by a low-temperature sputtering technique, it turned out that the diffraction peak intensity of the In_2O_3 crystal near 2 theta= 30.6 degree is large, and crystallinity is high.

[0109]The organic electroluminescence devices of the structure shown in drawing 3 like working

example 1 using this ITO board D were produced, the luminescent characteristic was measured similarly, and the result was shown in drawing 4 and Table 2.

[0110]Except for not having carried out optical polish for the surface of the mold of the glass which pours in a comparative example 3 photoresist monomer composition, the hardened material was obtained by the same method as working example 1. This hardened material was cut in the shape of slide glass, and it was considered as the substrate E. The various characteristics of this substrate E were as being shown in Table 1.

[0111]Next, the ITO transparent conducting film was deposited on this substrate E in the same low-temperature sputtering technique as working example 1, and it was considered as the ITO board E. The sheet resistance values of this ITO board E were 20ohms.

[0112]When the organic electroluminescence devices of the structure shown in drawing 3 like working example 1 using this ITO board E were produced and the same method estimated, the element carried out short circuit destruction in the stage which impressed 5V.

[0113]

[Table 1]

	外観	比重 (g/cm3)	落球衝撃試験 (cm)	曲げ弾性率 (kg/mm2)	Rz (nm)	屈折率	複屈折率 (nm)	吸水性 (%)	ガラス転移温度 (℃)
実施例1 (基板A)	無色透明	1.25	40	260	12.4	1.60	<10	0.2	150
実施例2 (基板B)	無色透明	1.20	60	350	12.8	1.53	<10	0.2	200
比較例1 (基板C)	無色透明	2.76	20	7000	3.7	1.53	<1	<0.01	>400
比較例3 (基板E)	無色透明	1.25	40	260	98.2	1.60	<10	0.2	150

[0114]

[Table 2]

評価項目 / 素子	発光輝度 (cd/m^2)	発光効率 (lm/W)	L／J (cd/A)
実施例 1 (基板A)	18320	3.72	8.18
実施例 2 (基板B)	10910	4.39	9.75
比較例 1 (基板C)	2047	3.10	7.88
比較例 2 (基板D)	11770	2.59	5.74
比較例 3 (基板E)	短絡破壊	——	——

●発光輝度,発光効率：15Vでの測定値
●L／J：輝度-電流密度特性を直線で近似したときの傾きで、
量子効率に対応した量

[0115]
[Effect of the Invention]According to organic electroluminescence devices of this invention, and a manufacturing method for the same, the organic electroluminescence devices which have the characteristic more than equivalent also in a luminescent characteristic as compared with the element using the conventional glass substrate can be obtained for high productivity using the plastic plate whose mechanical strength it is lightweight and is large as explained in full detail above.
[0116]Therefore, the light source in which the organic electroluminescence devices by this invention employed the feature as a flat panel display (for example, the object for OA computers and a flat TV), or a surface light object efficiently. The application to (for example, the light source of a copying machine and the back light source of a performance display or instruments), the plotting board, and a beacon light is expected, and the technical value is very large.